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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/827,529	04/20/2004	Shuhei Yada	1417-460	2966

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EXAMINER

PUTTLITZ, KARL J

ART UNIT	PAPER NUMBER
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1621

DATE MAILED: 05/03/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/827,529

Applicant(s)

YADA ET AL.

Examiner

Karl J. Puttlitz

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 February 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-13 is/are pending in the application.
- 4a) Of the above claim(s) 10-13 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-9 is/are rejected.
- 7) ☒ Claim(s) 3 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☒ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 2/23/2006
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

Applicant's election of Group I, claims 1-9 in the reply filed on 2/23/2006 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).

Priority

Acknowledgment is made of applicant's claim for foreign priority based on JP 2002-8918 on 1/17/2002. It is noted, however, that applicant has not filed a certified copy of the JP 2002-8918 application as required by 35 U.S.C. 119(b).

Claim Objections

Claim 3 objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Specifically, claim 3 recites that the (meth)acrylic acid solution to be introduced into the distillation column is mixed with oxygen or an oxygen-containing gas, and then introduced into the distillation column, which is already covered in claims 1 and 2.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 4,260,821 to Benjamin et al. (Benjamin in view of EP 1041062 to NIPPON SHOKUBAI CO., LTD. (EP 062).

The rejected claims are drawn to a process for producing (meth)acrylic acid, comprising: contacting a reaction gas containing (meth)acrylic acid obtained by gas-phase catalytic oxidation, with an absorbent solvent to prepare a (meth)acrylic acid solution; and introducing the (meth)acrylic acid solution into a distillation column to purify (meth)acrylic acid, after adjusting a dissolved oxygen concentration in the (meth)acrylic acid solution to be introduced into the distillation column to not less than 12 ppm by weight, the (meth)acrylic acid solution being fed to the distillation column.

The rejected claims are also drawn to those embodiments wherein the (meth)acrylic acid solution to be introduced into the distillation column is mixed with oxygen or an oxygen-containing gas to adjust the dissolved oxygen concentration in the (meth)acrylic acid solution.

The rejected claims are also drawn to those embodiments wherein the (meth)acrylic acid solution to be introduced into the distillation column is mixed with oxygen or an oxygen-containing gas, and then introduced into the distillation column.

The rejected claims are also drawn to those embodiments wherein the (meth)acrylic acid solution to be introduced into the distillation column is mixed with oxygen or an oxygen-containing gas, subjected to a gas-liquid separation, and then introduced into the distillation column.

The rejected claims are also drawn to those embodiments wherein the mixing of the (meth)acrylic acid solution with oxygen or the oxygen-containing gas is performed in a conduit for introducing the (meth)acrylic acid solution into the distillation column, or a static mixer or an orifice disposed in the conduit.

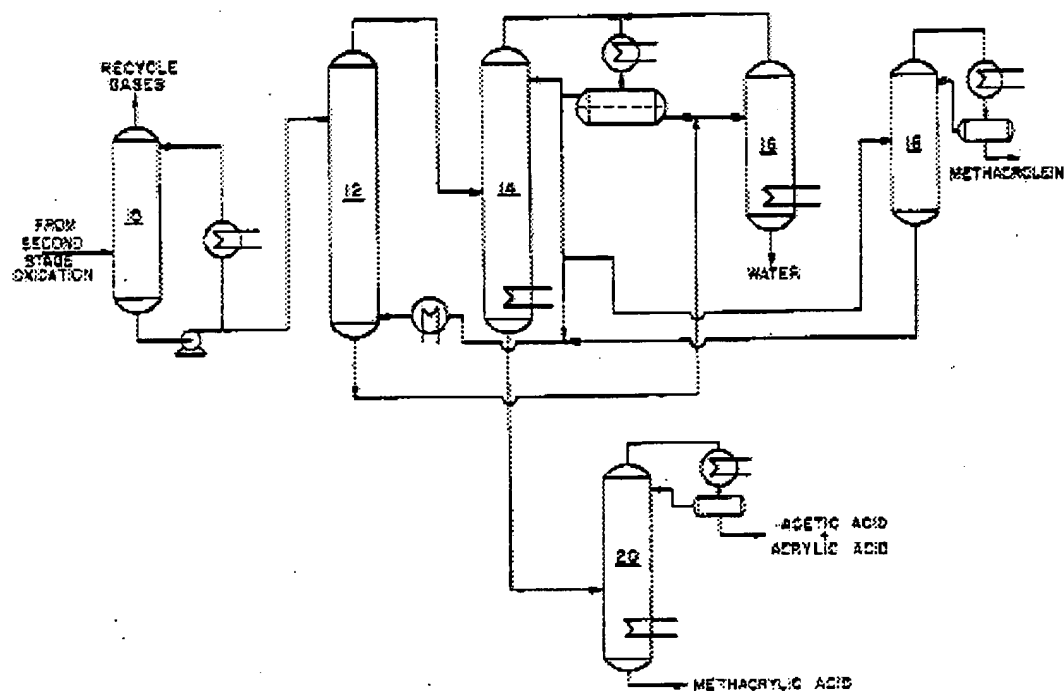
The rejected claims are also drawn to those embodiments wherein the dissolved oxygen concentration in the (meth)acrylic acid solution is adjusted in a facility disposed on an upstream side of the distillation column.

The rejected claims are also drawn to those embodiments wherein the (meth)acrylic acid solution is in the form of an aqueous solution, the distillation column is an azeotropic dehydration distillation column, and at least a part of a phenol-based polymerization inhibitor is fed to the azeotropic dehydration distillation column from a raw material feed stage thereof or a position higher than the raw material feed stage, and a copper-based polymerization inhibitor is fed to the azeotropic dehydration column from a position lower than the raw material feed stage.

The rejected claims are also drawn to those embodiments wherein the azeotropic dehydration column is any of a perforated plate column, a packed column and a combination of a perforated plate column and a packed column.

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With regard to the above embodiments, Benjamin teaches a methacrylic acid recovery process in conjunction with the following figure 1:



wherein the cooling and condensation of reactor effluent gases in quench tower 10. Residual gases are separated and recycled to the second-stage reactor (i.e., a gas liquid separation, see claim 4). Also, the tower 10 is equipped with a valve (see claim 6). Extraction of crude methacrylic acid with a suitable solvent is carried out in column 12. Purification of the acid includes separation of the solvent from crude methacrylic acid (including acetic acid) by distillation in column 14 with recirculation of the solvent to the extraction step. Crude methacrylic acid is separated into a pure methacrylic acid product and a by-product stream containing acetic acid and acrylic acid as the principal constituents in column 20. Purification of the acetic acid may be carried out in subsequent distillations, not shown.

Although most of the water in the reactor effluent is rejected during the solvent extraction, a certain amount of water is carried into the solvent recovery column 14 and is separated from the solvent in the overhead facilities. The combined water from the extraction column 12 and solvent recovery column 14 is overhead is stripped of dissolved solvent in column 16 and rejected, while the recovered solvent is returned to the solvent recovery column (14) overhead equipment. A portion of the unreacted methacrolein tends to accumulate in the solvent and recovery by distillation of a slip stream of solvent is generally economically justified. Such a column is shown as 18 in FIG. 1.

The patent teaches that fouling and/or plugging of the distillation columns, and particularly their reboilers, is a common problem when processing solvent rich in methacrylic acid and acetic acid. The nature of the fouling materials is not fully known, however, it has been found that by use of conventional inhibitors, particularly hydroquinone, fouling may be greatly reduced, but only when used in conjunction with oxygen injection at a rate above a predetermined threshold value which has been found necessary to prevent serious fouling of the equipment.

Benjamin teaches that inhibitors which may be used in conjunction with the present invention include those known in the art such as aromatic phenols, aromatic amines, and quinones. Hydroquinone and the commercially available A-30, 2,4 dimethyl 6 t-butyl phenol available from DuPont, along with Topanol A, 2,4 dimethyl 6 t-butyl phenol available from ICI United States, Inc., have been found to be useful. The

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amounts of inhibitor(s) will be generally similar to those known in the art, typically between 100 and 1000 ppm (wt). See columns 3 and 4.

In particular, Benjamin teaches that the appearance of polymers and/or other high-boiling materials as solids during the recovery of methacrylic acid produced by oxidation of methacrolein can be minimized by the use of known inhibitors such as hydroquinone and the like, and the introduction of molecular O₂, in the form of air or enriched air, at a rate above a threshold value, defined as the amount of oxygen above which no significant reduction of the rate of appearance of solids occurs. The threshold value is primarily affected by the temperature of the boiling liquids where solid polymers are expected to appear. At an operating temperature of about 120°C the threshold value is at about 0.1 SLH O₂ /100 gms of liquid. See column 2, lines 43-64, and claim 1.

The difference between the process covered in the rejected claims and the process disclosed in Benjamin, is that Benjamin fails to expressly disclose that the (meth)acrylic acid solution is fed to the distillation column after adjusting a dissolved oxygen concentration in the (meth)acrylic acid solution, or more specifically, a conduit for introducing the (meth)acrylic acid solution into the distillation column, or a static mixer or an orifice disposed in the conduit, or facility upstream from the distillation column. Also, Benjamin fails to teach copper-based polymerization inhibitors (claim 8), or the specific columns required by the claims, e.g., an azeotropic distillation column. It is for this proposition, however, that the examiner joins EP 062. In this regard, EP 062 teaches a process for producing (meth)acrylic acid. In particular, the patent teaches that a polymerization inhibitor adding to a distillation no particular restriction. This

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polymerization inhibitor may be directly fed into the distillation column or it may be dissolved in a feed solution, a reflux liquid, or other solvent and then fed in the form of the resultant solution to the distillation column via the feed line. See paragraph [0027]. Copper-based polymerization inhibitors are taught in paragraph [0026]. EP 062 also teaches that examples of the distillation column may be cited a solvent separation column, an azeotropic separation column, an acetic acid separation column, and a high boiling component separation column. See paragraph [0028].

Accordingly, EP 062 demonstrates that adding a solids/polymerization inhibitor before distillation of methacrylic acid in an azeotropic distillation column, and moreover, with a copper based polymerization inhibitor, is routine in the art, and thus, well within the motivation of those of ordinary skill. Accordingly, those of ordinary skill would have been motivated to modify the disclosure of Benjamin to include a step of adding a solids/polymerization inhibitor before distillation of methacrylic acid in the required columns, and additionally, with a copper based polymerization inhibitor, since EP 062 demonstrates that such steps are fundamental in methacrylic acid recovery systems. Therefore, the rejected claims are prima facie obvious since the combination of Benjamin and EP 062 teaches, or suggests, the elements of these claims with a reasonable expectation of success.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karl J. Puttlitz whose telephone number is (571) 272-

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0645. The examiner can normally be reached on Monday to Friday from 9 a.m. to 5 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Johann Richter, can be reached at telephone number (571) 272-0646. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Karl J. Puttlitz
Assistant Examiner